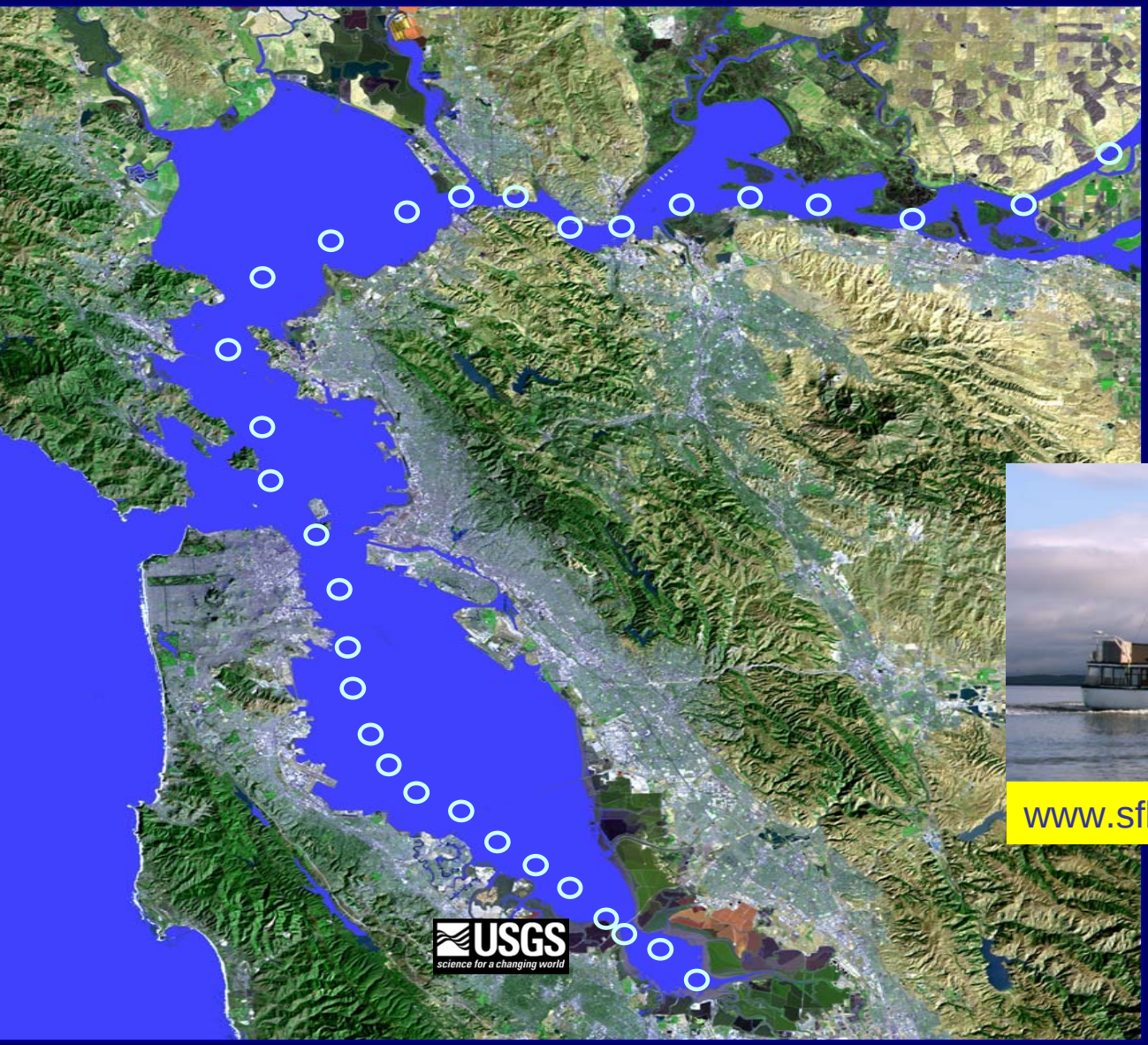
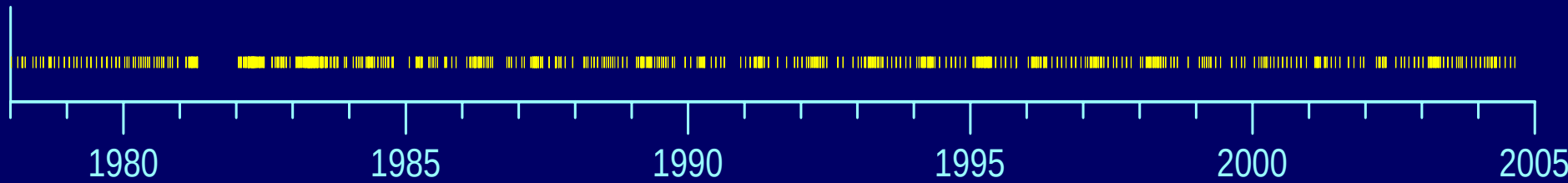


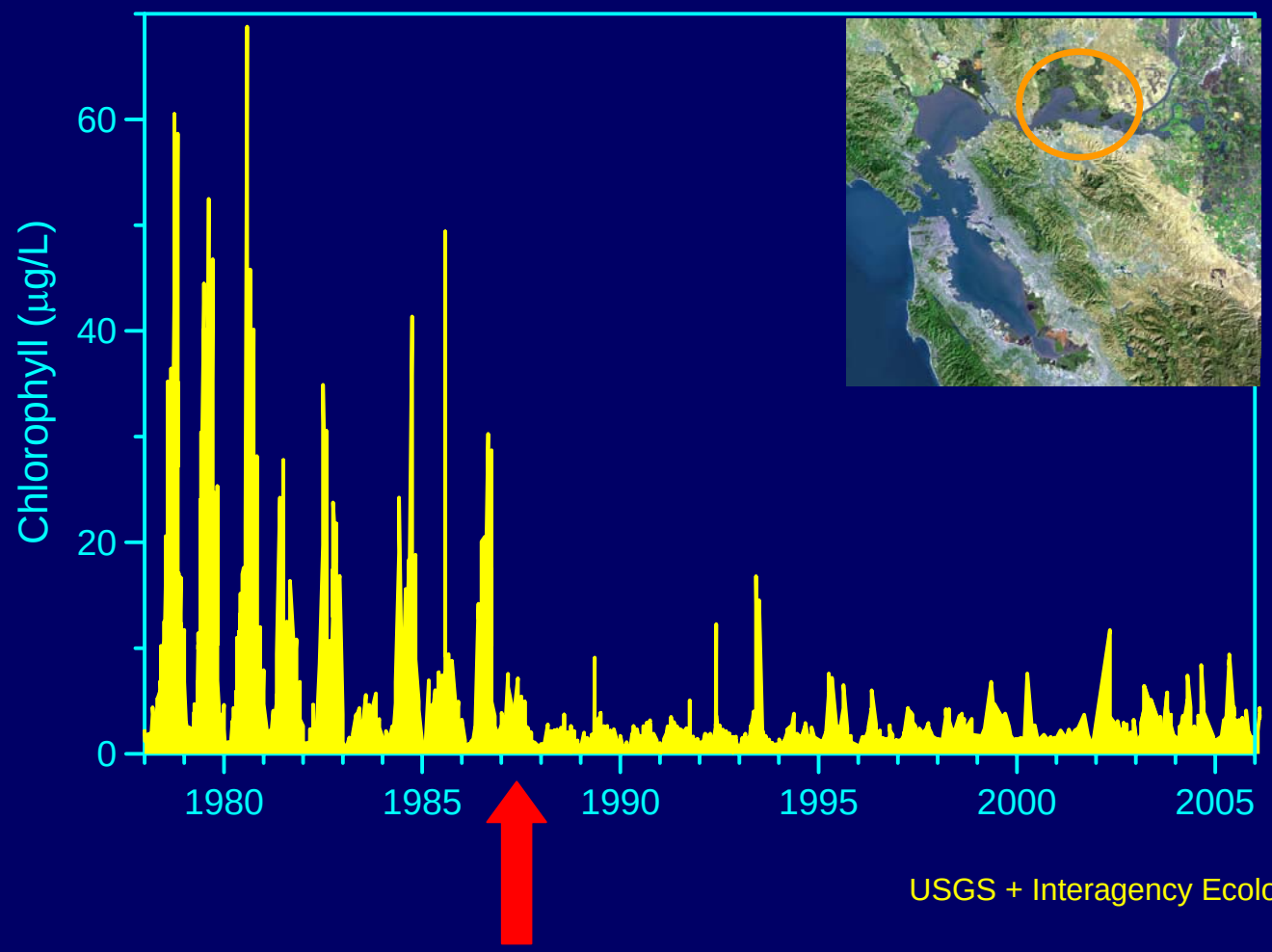
Nutrients
Salinity
Temperature
Turbidity
Dissolved Oxygen
Chlorophyll

www.sfbay.wr.usgs.gov/access/wqdata



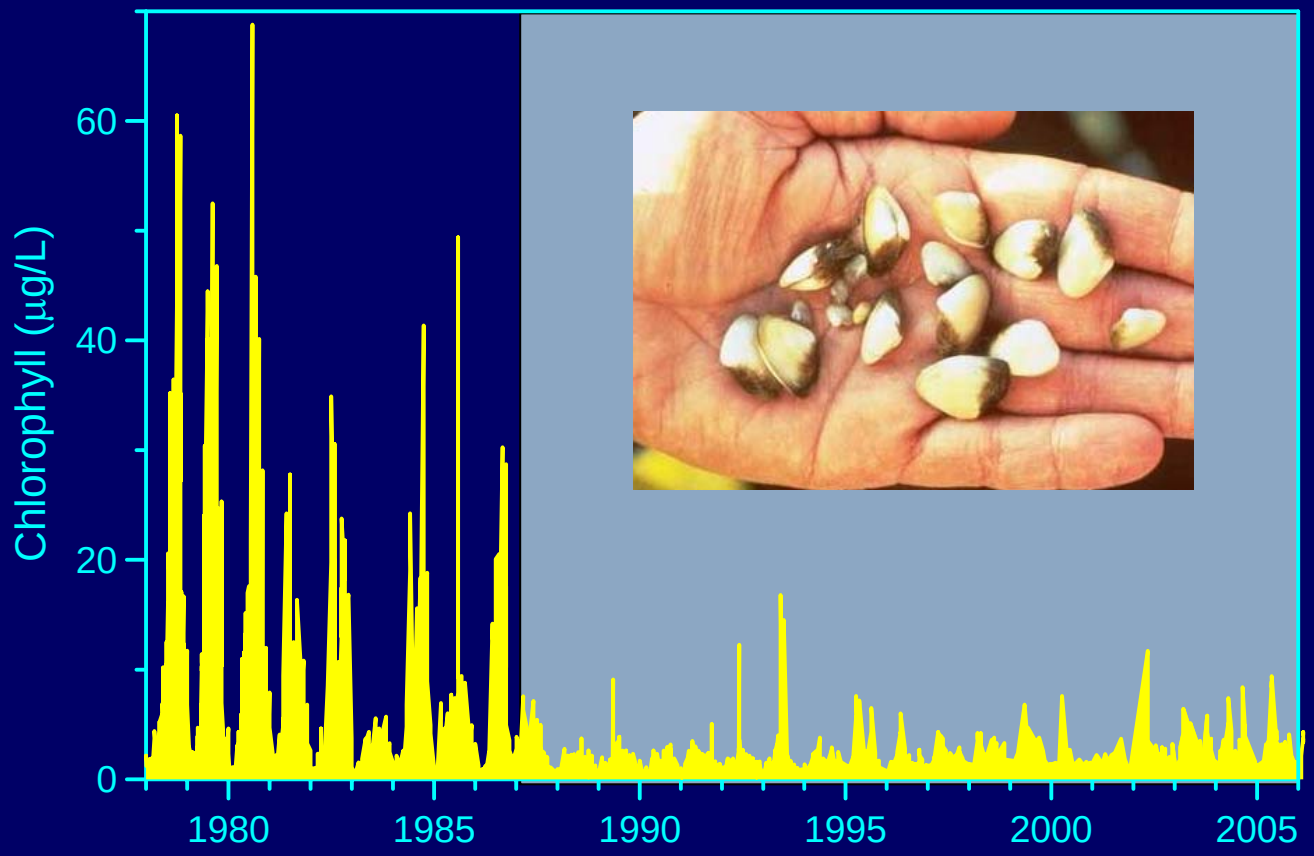
USGS
science for a changing world

Story 1: North Bay

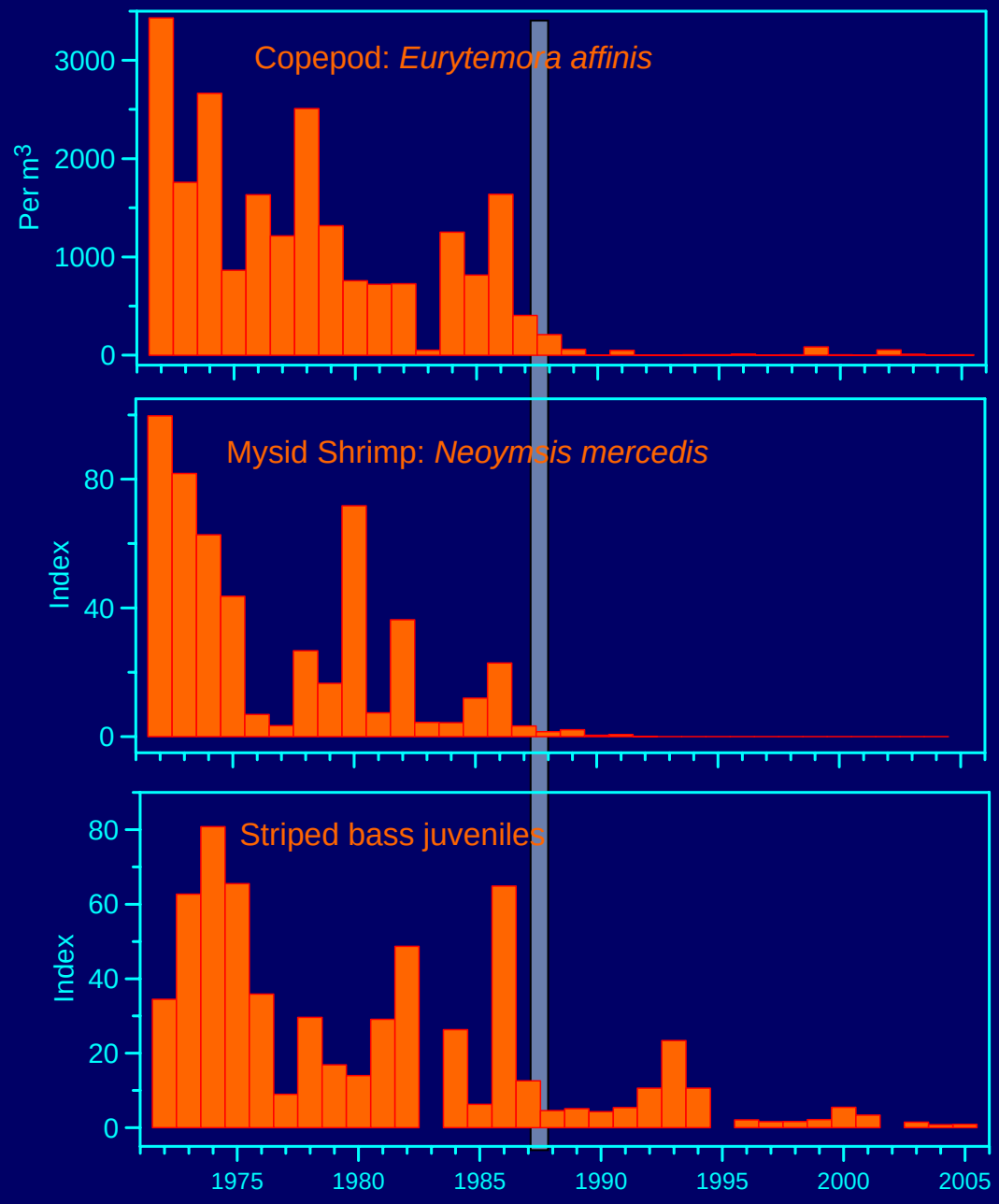


USGS + Interagency Ecological Program

Corbula amurensis

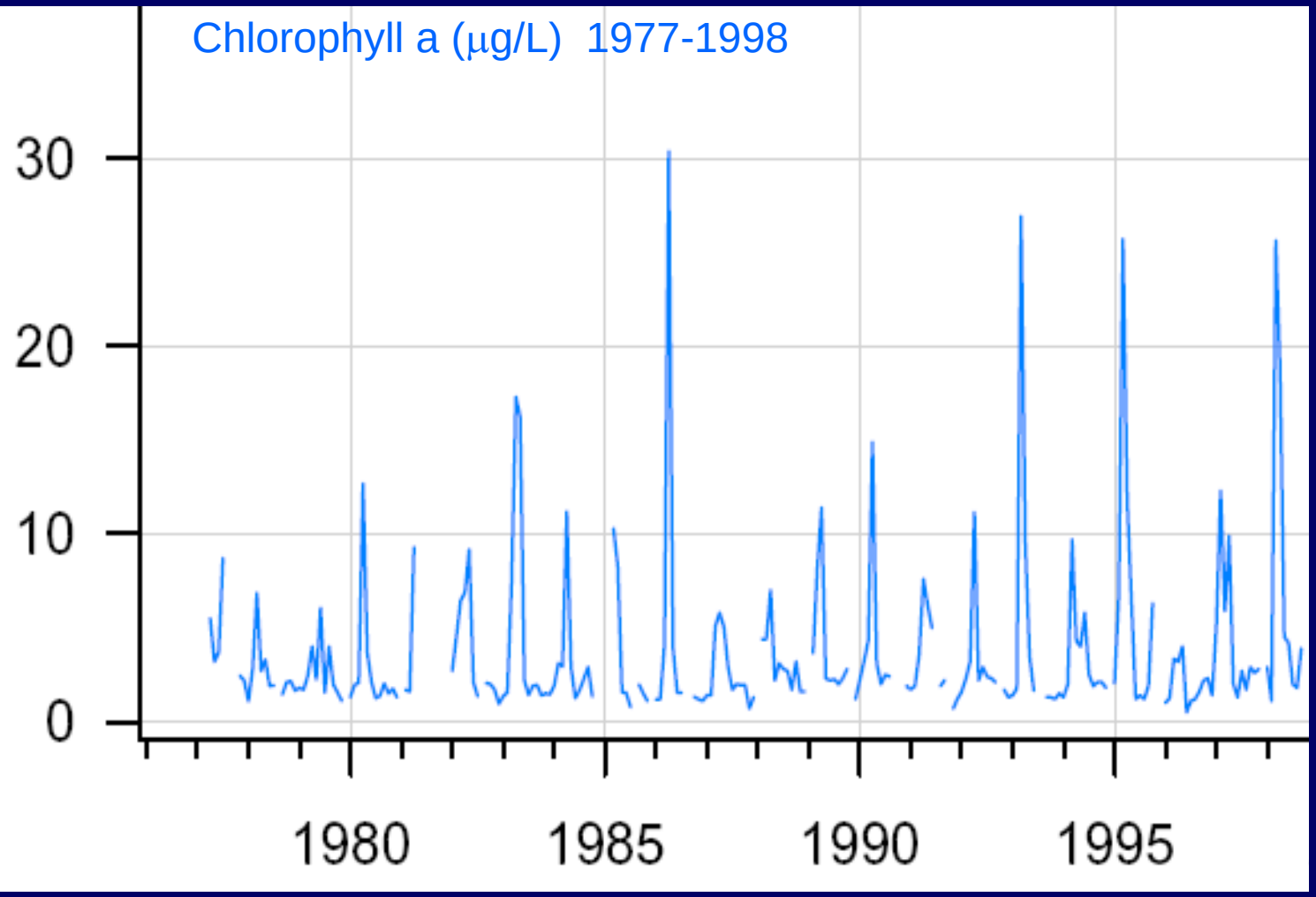


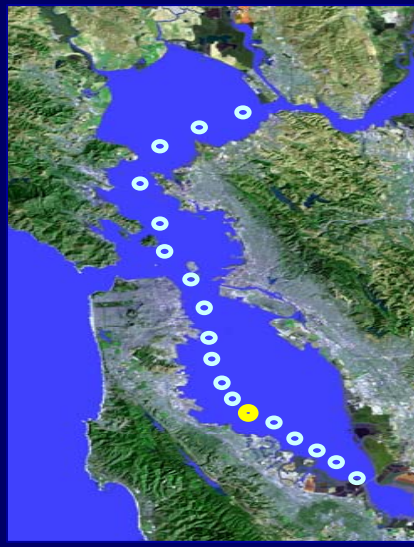
Interagency Ecological Program

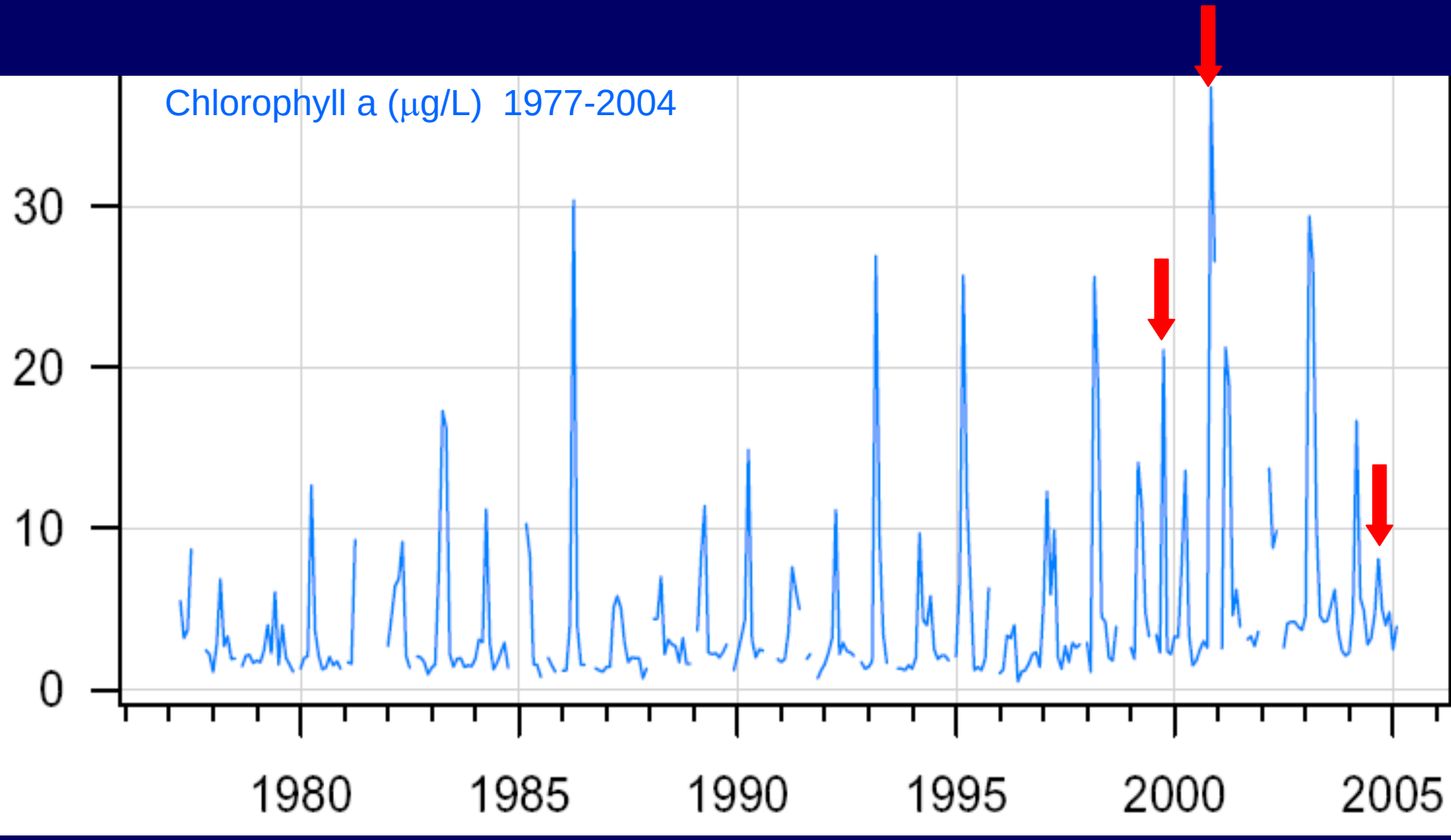


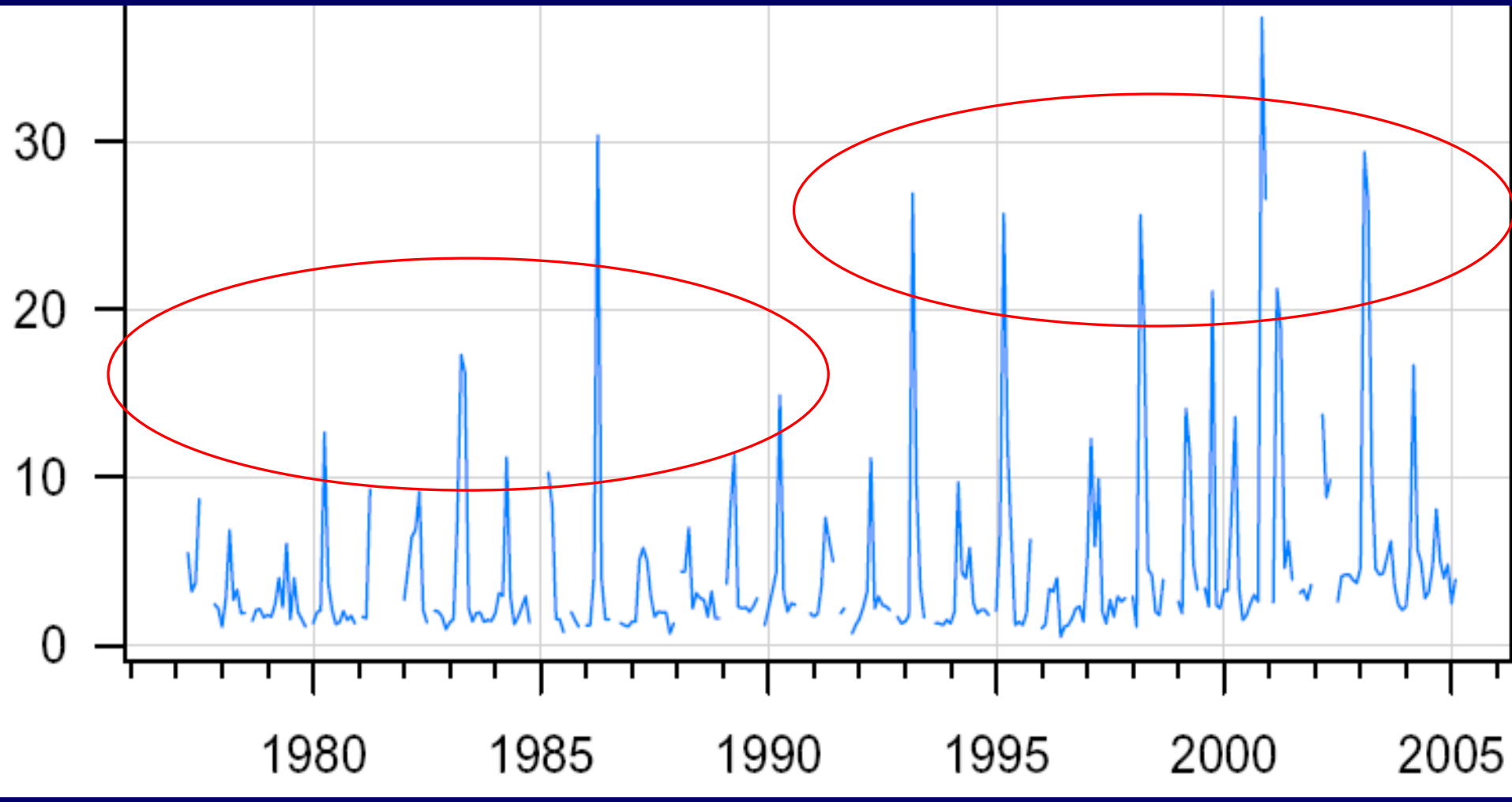
California Department of Fish & Game

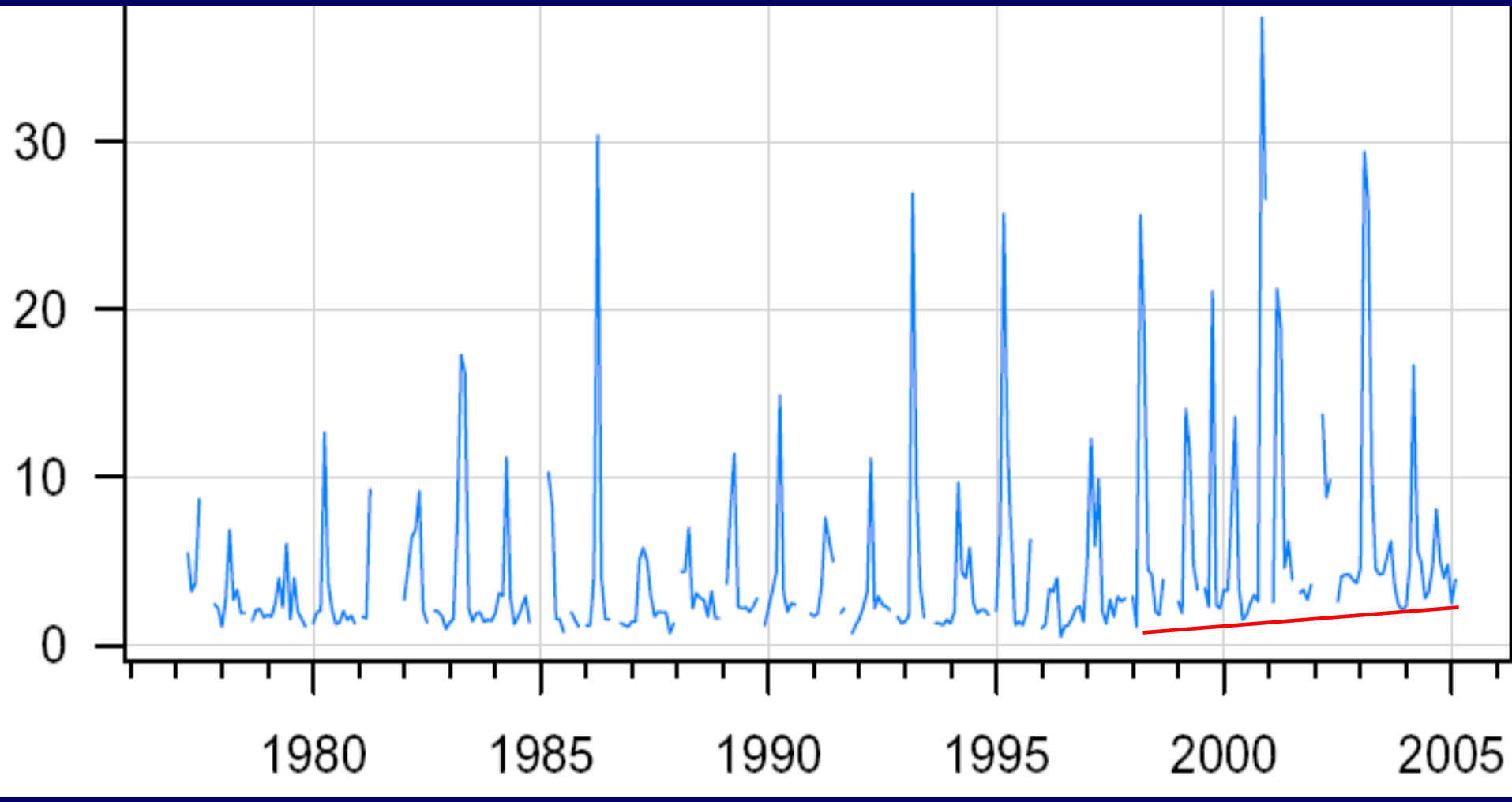
Story 2: South Bay



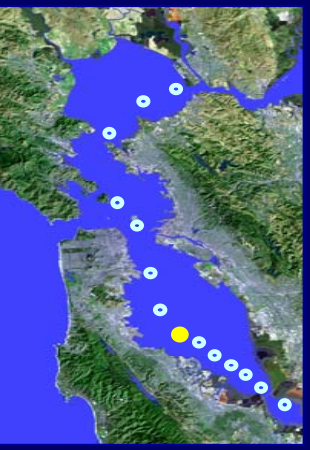


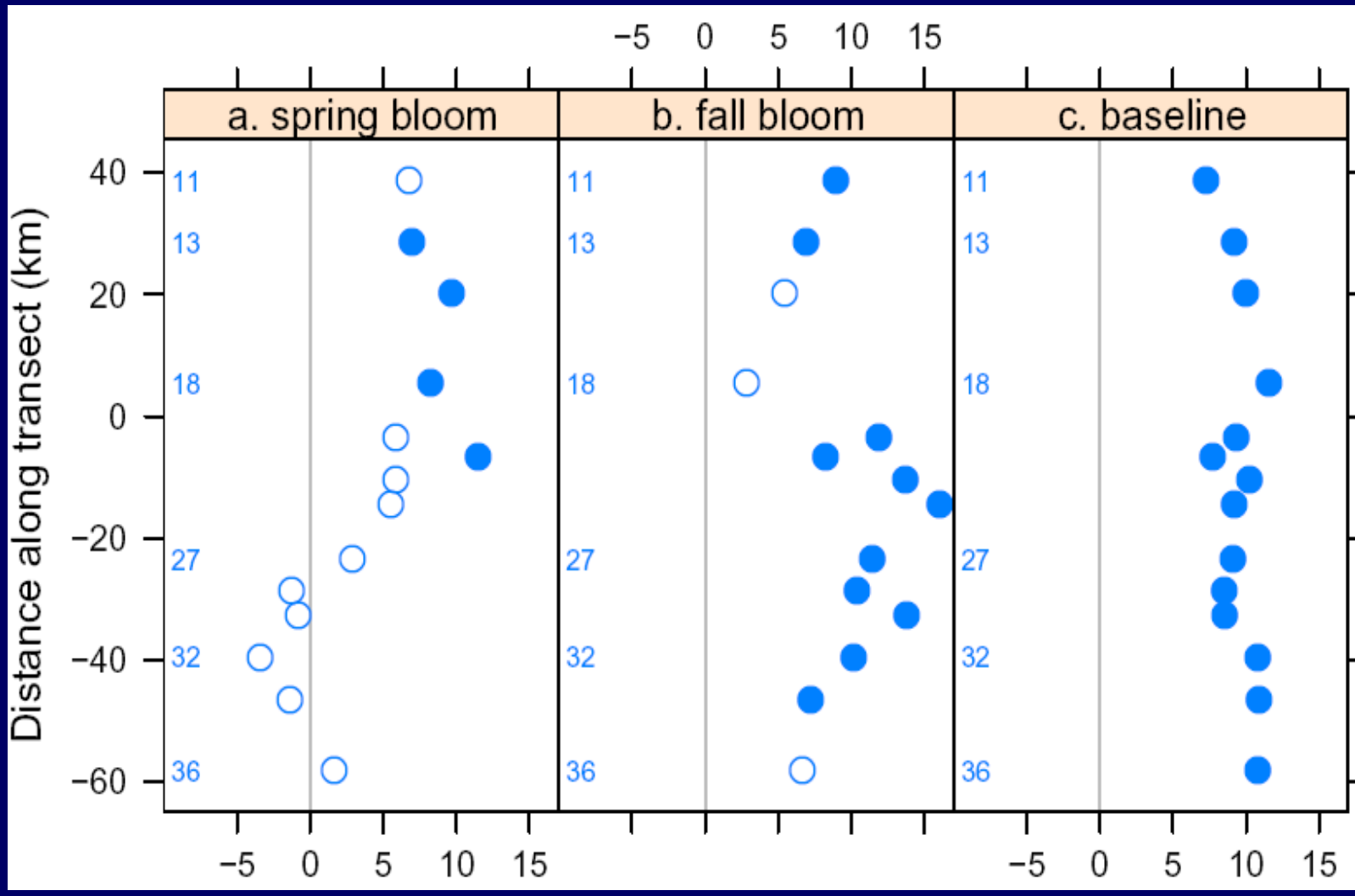

Chlorophyll a (µg/L) 1977-2004
30
20
10
0
1980
1985
1990
1995
2000
2005


30
20
10
0
1980
1985
1990
1995
2000
2005

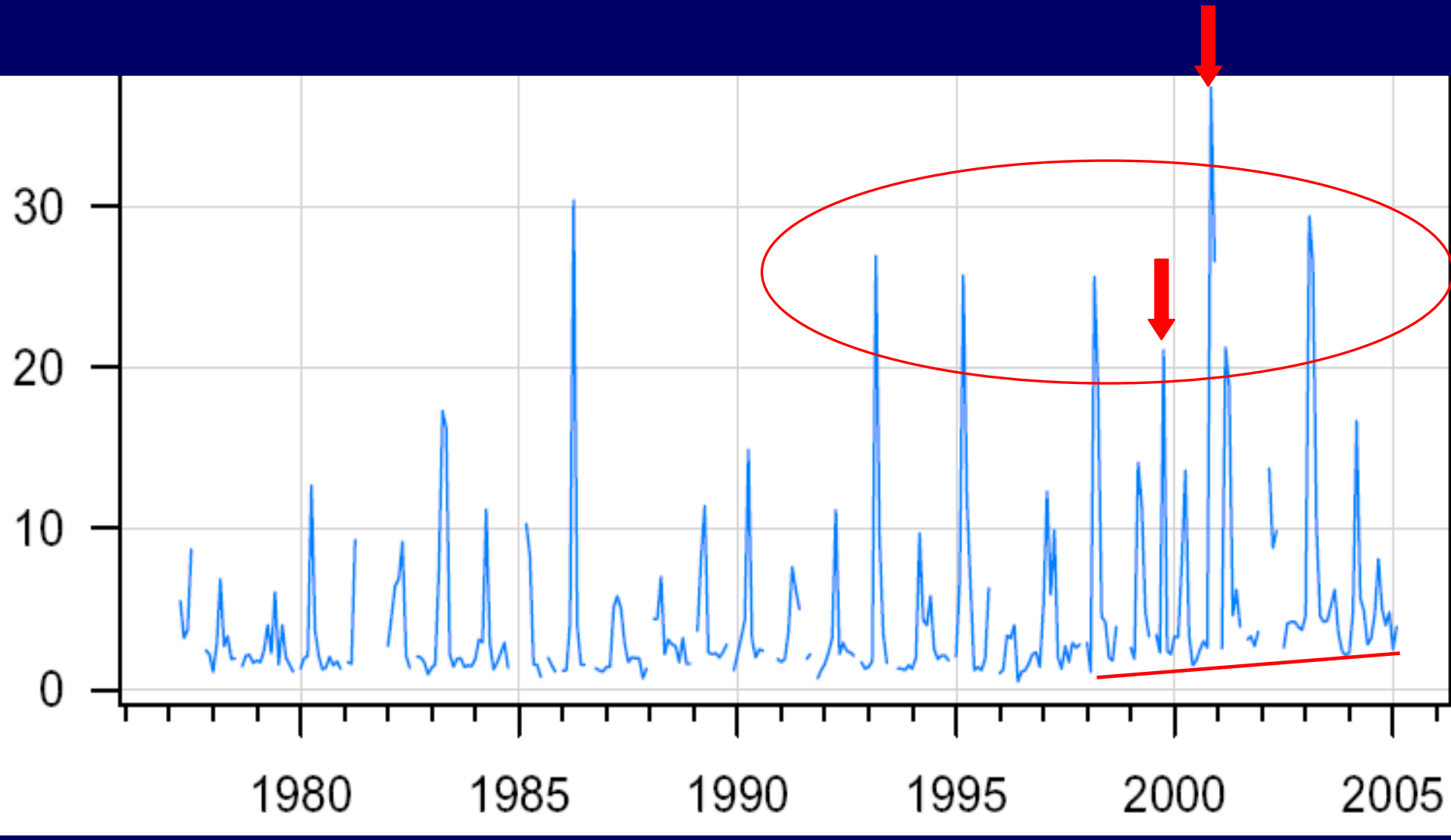

30
20
10
0
1980
1985
1990
1995
2000
2005

Seasonal Kendall Test (Helsel & Hirsch 1992)





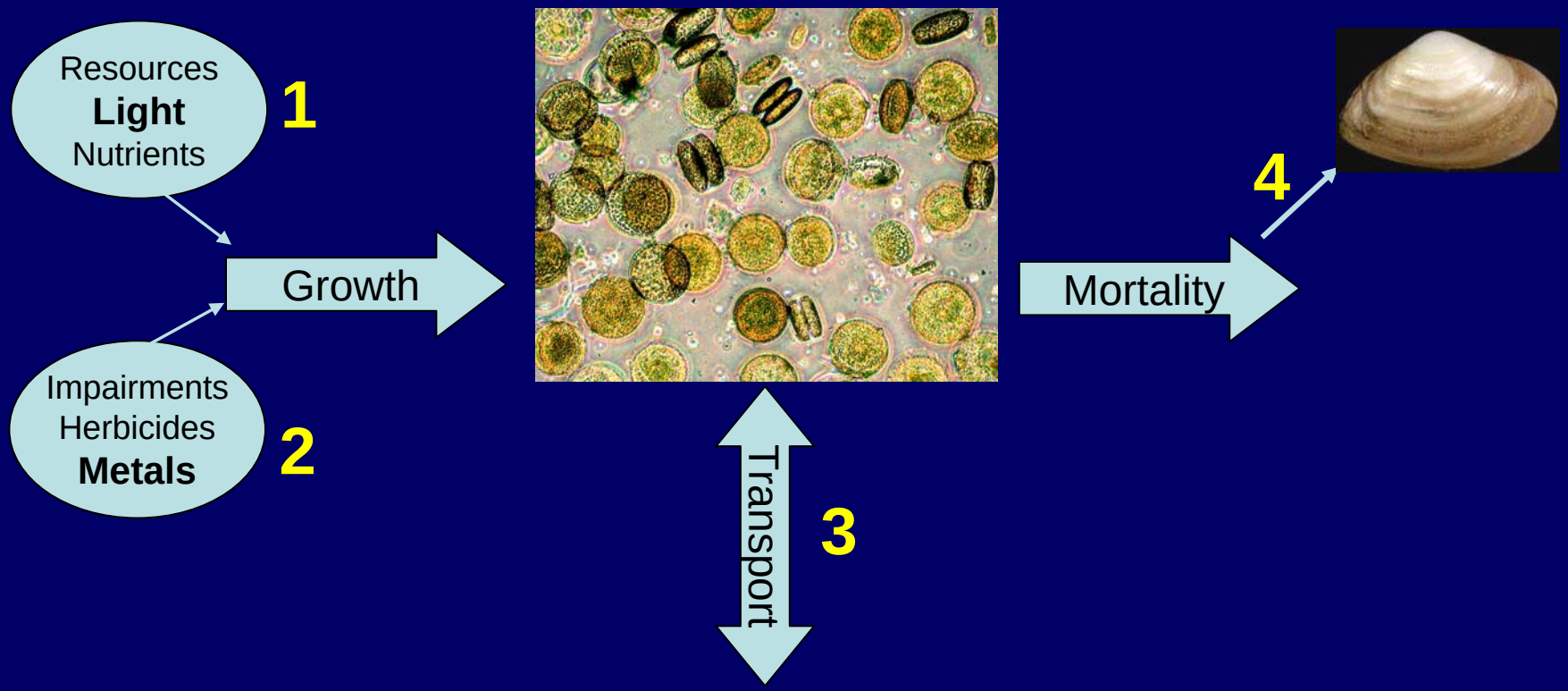
% per year

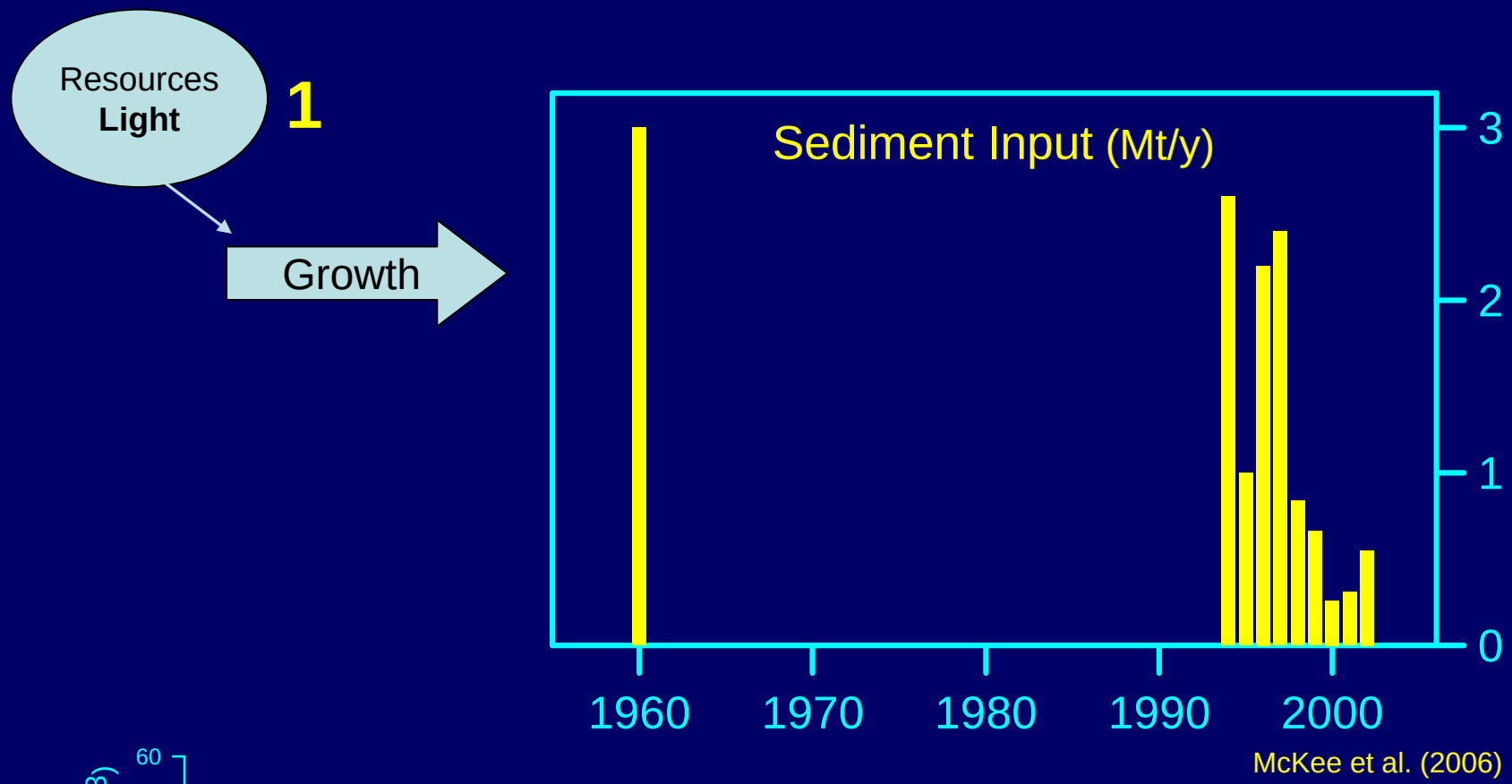


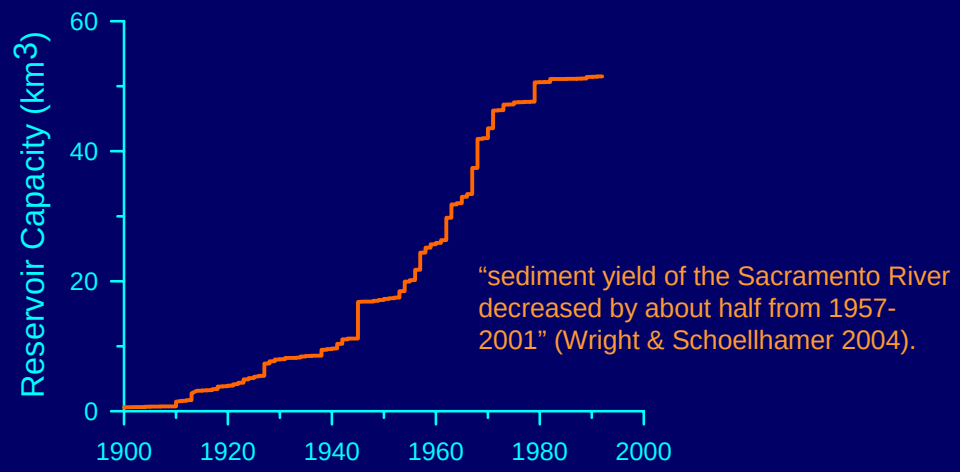
- Ecologically Important
- NOT related to nutrient (N,P) increases

Why is phytoplankton increasing in San Francisco Bay?

Four Hypotheses



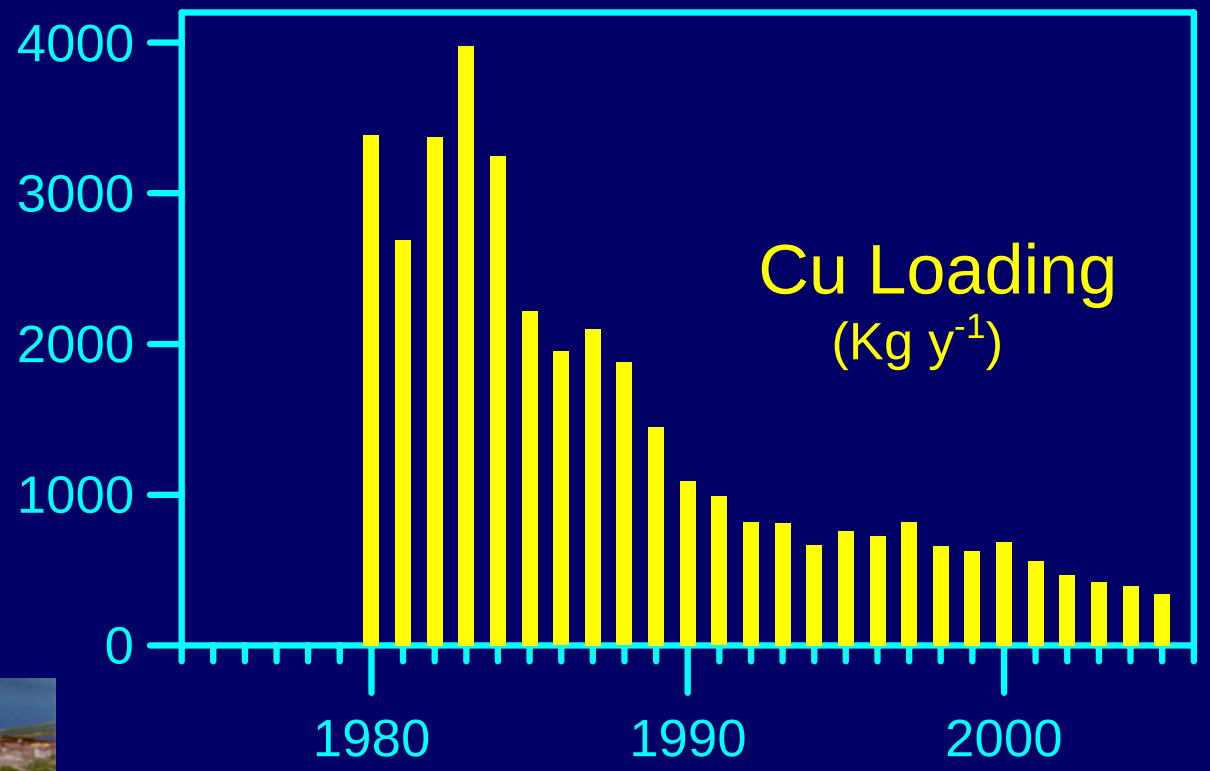

Resources
Light
1
Growth
Sediment Input (Mt/y)
3
2
1
0
1960
1970
1980
1990
2000
McKee et al. (2006)


Reservoir Capacity (km3)
60
40
20
0
1900
1920
1940
1960
1980
2000
"sediment yield of the Sacramento River decreased by about half from 1957-2001" (Wright & Schoellhamer 2004).

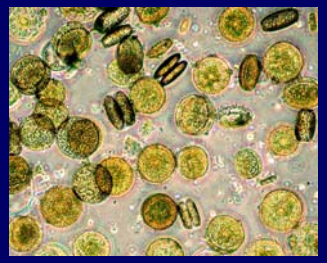
Growth

Impairments
Metals

2

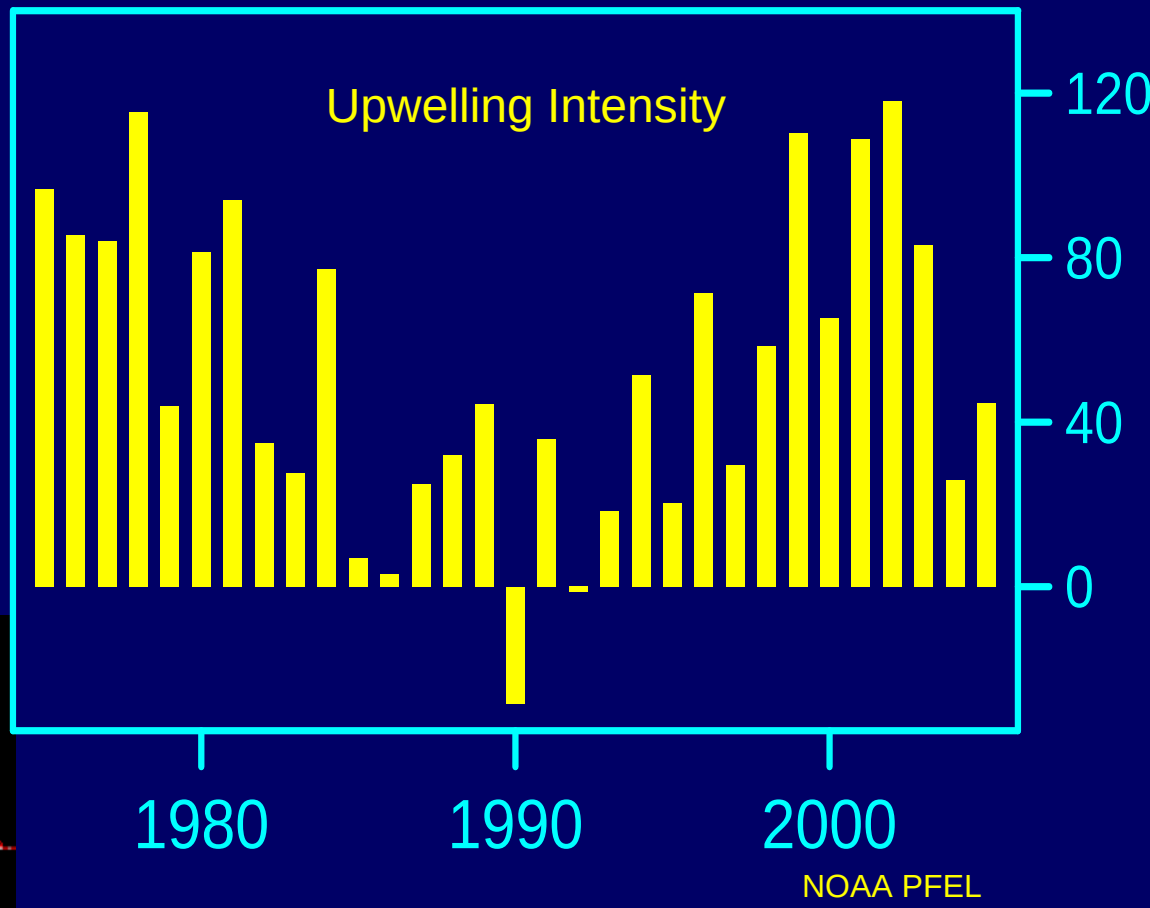


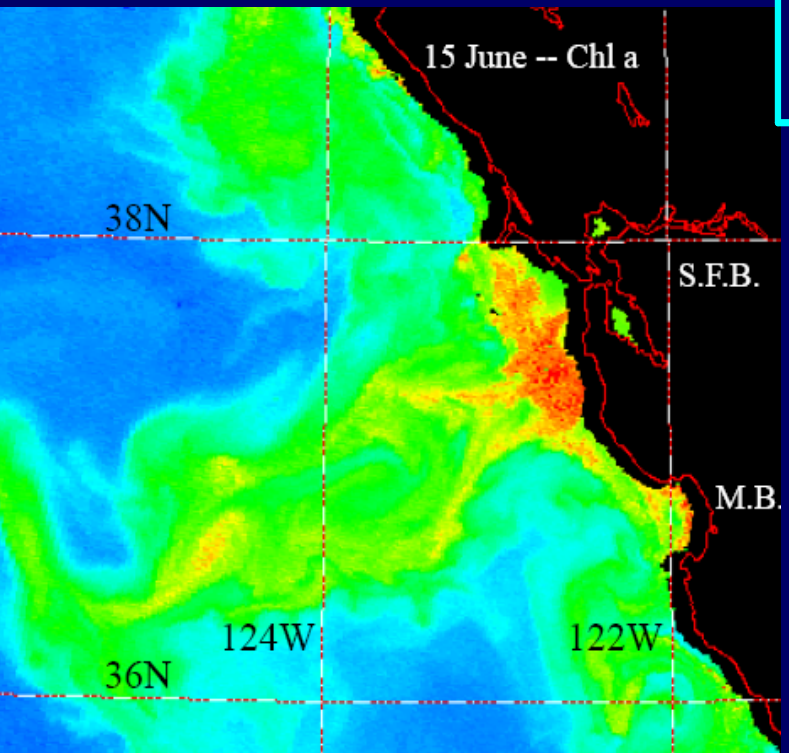
City of San Jose, Environmental Services (2006)

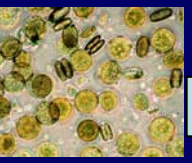


Transport

3

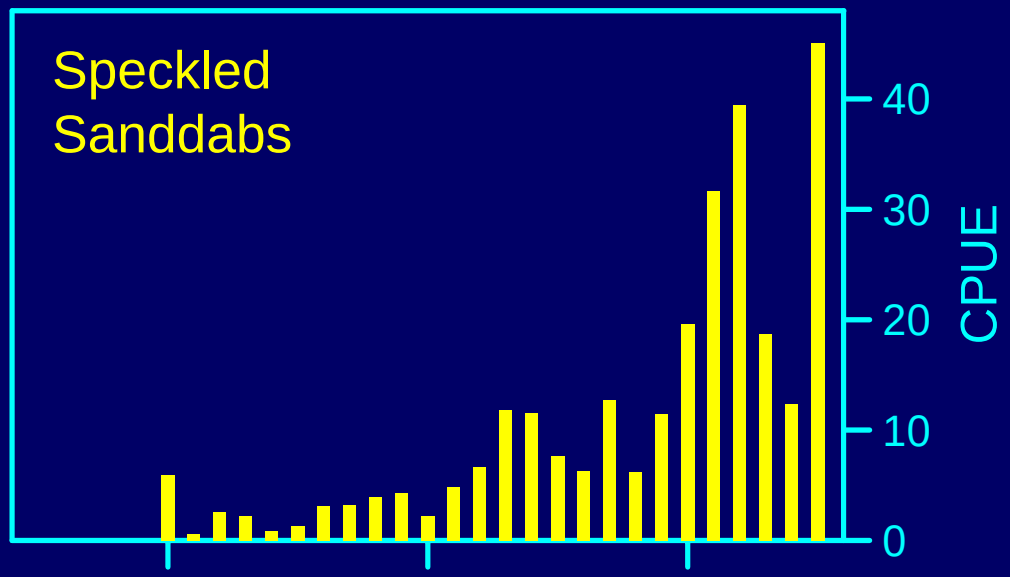

Upwelling Intensity
120
80
40
0
1980
1990
2000
NOAA PFEL

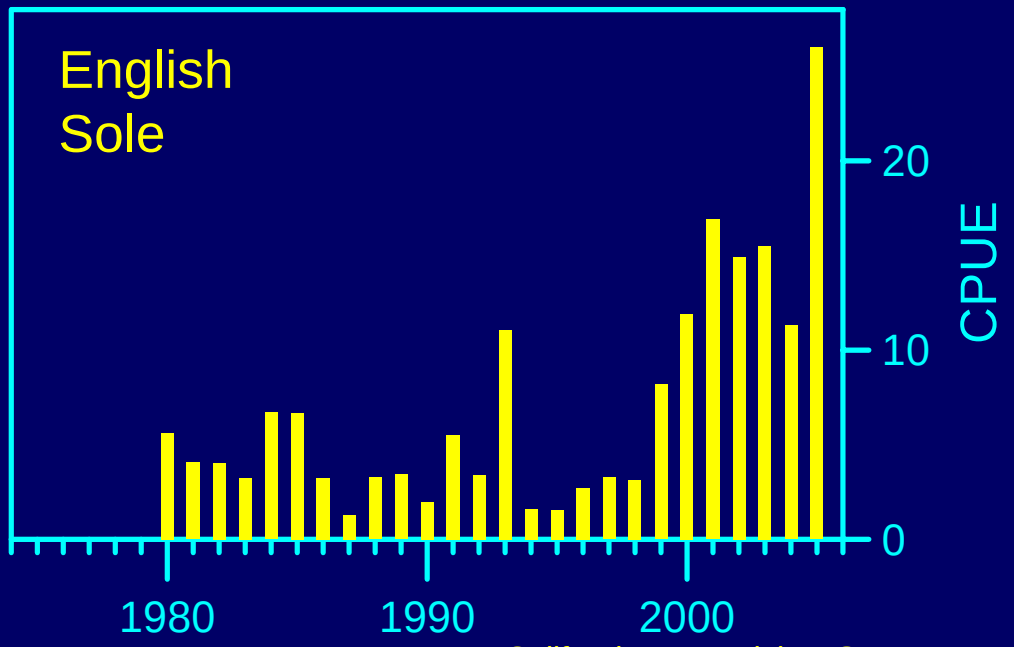

15 June -- Chl a
38N
S.F.B.
M.B.
124W
122W
36N



Mortality

4





California Dept. Fish & Game

Lessons

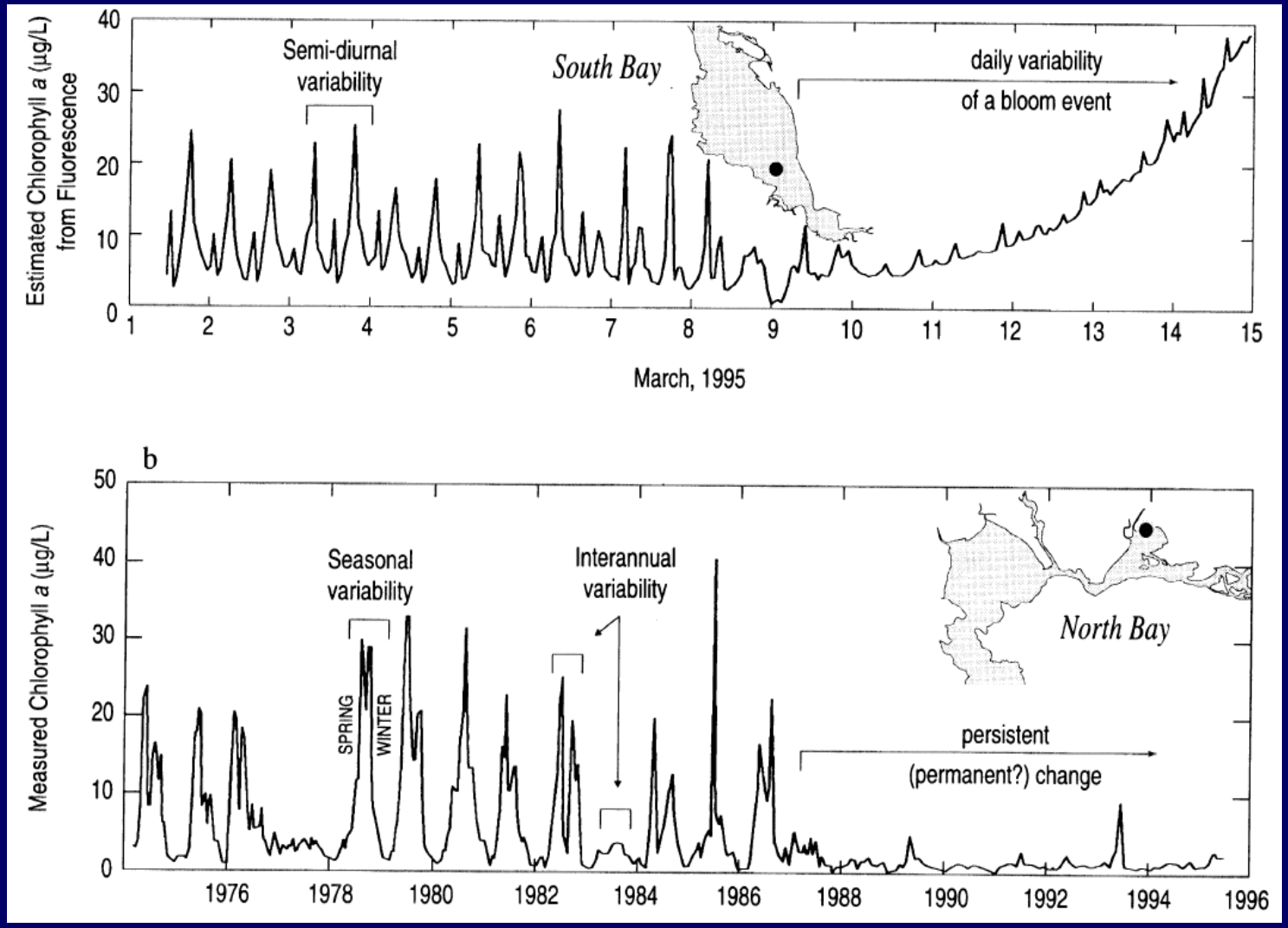
- **aquatic ecosystems are in perpetual state of change**
- **unraveling the processes is particularly challenging in estuaries**
- **water quality is influenced by connectivity to the coastal ocean and local watersheds**
- **alien species can be as disruptive as chemical pollution**
- **phytoplankton dynamics are influenced by more than nutrient loadings**

Thanks to Tara Schraga, Kate Dallas, Alan Jassby, Jan Thompson, Dave Schoellhamer, Kathy Hieb, San Jose Environmental Services, Regional Monitoring Program

USGS
science for a changing world

Photo: Steve Hager

Chlorophyll varies at time scales from hours to decades

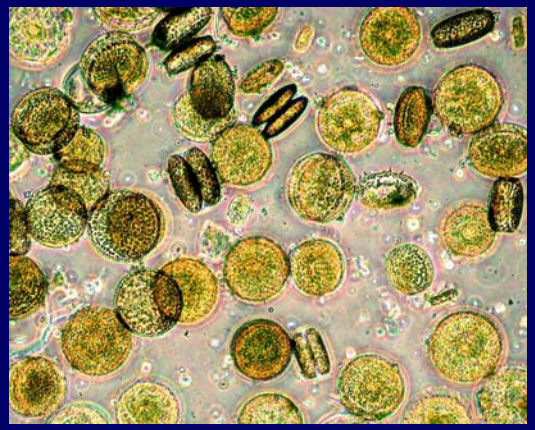


Conceptual Model

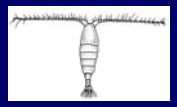
Resources
Light
Nutrients

Impairments
Herbicides
Metals

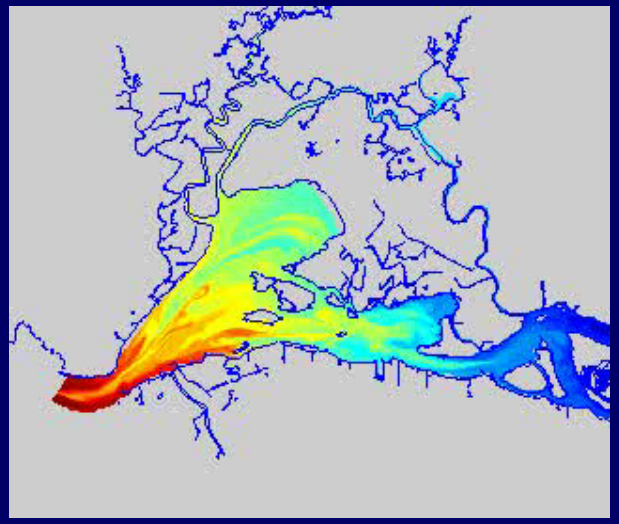
Growth



Mortality



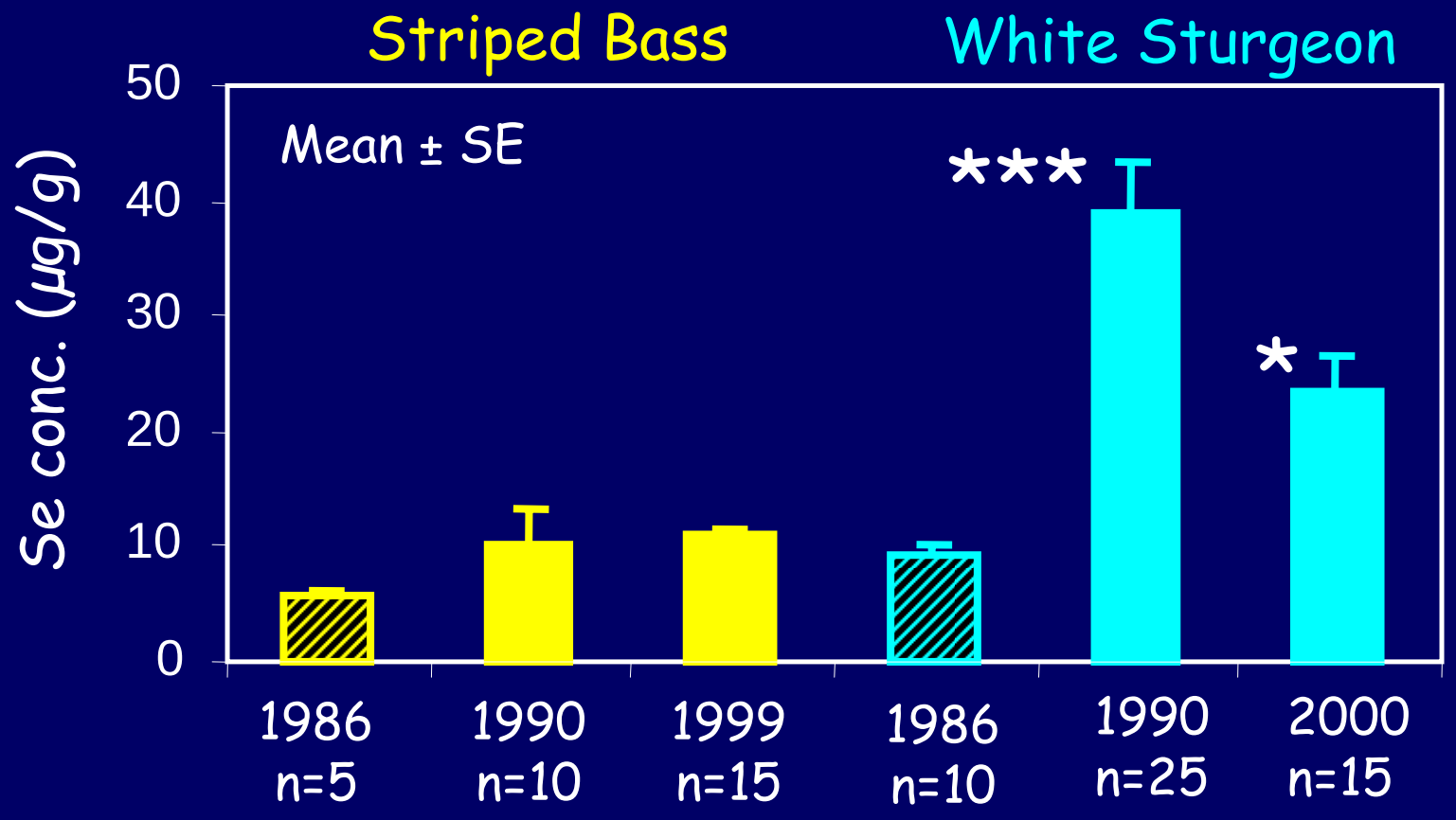
Transport



Nancy Monsen

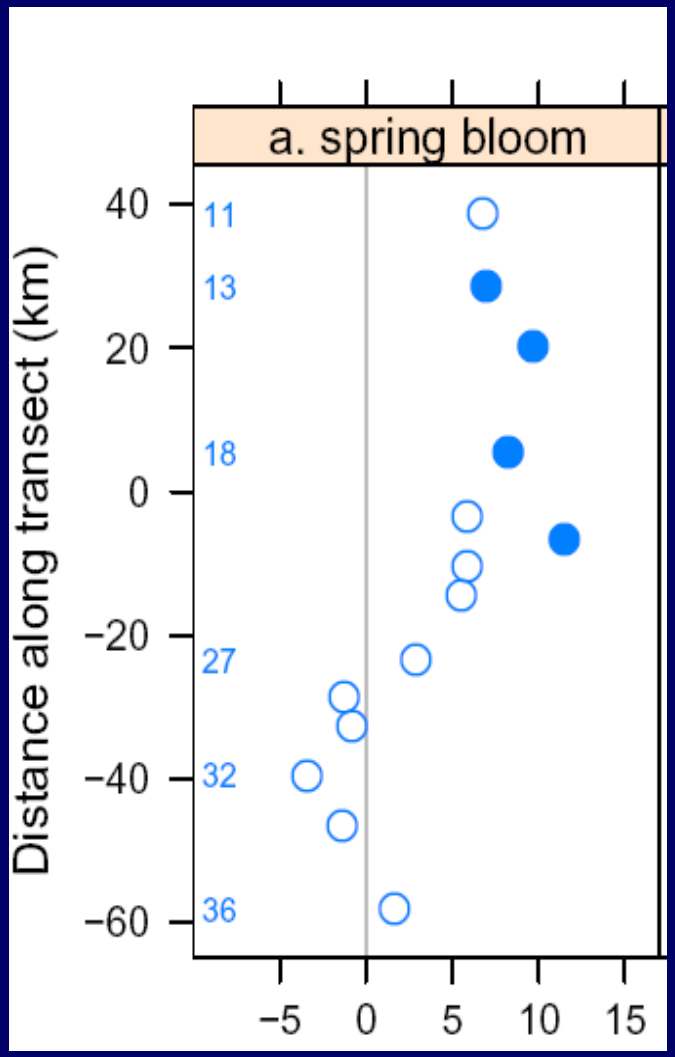
Robin Stewart (USGS):

Selenium concentrations in fish

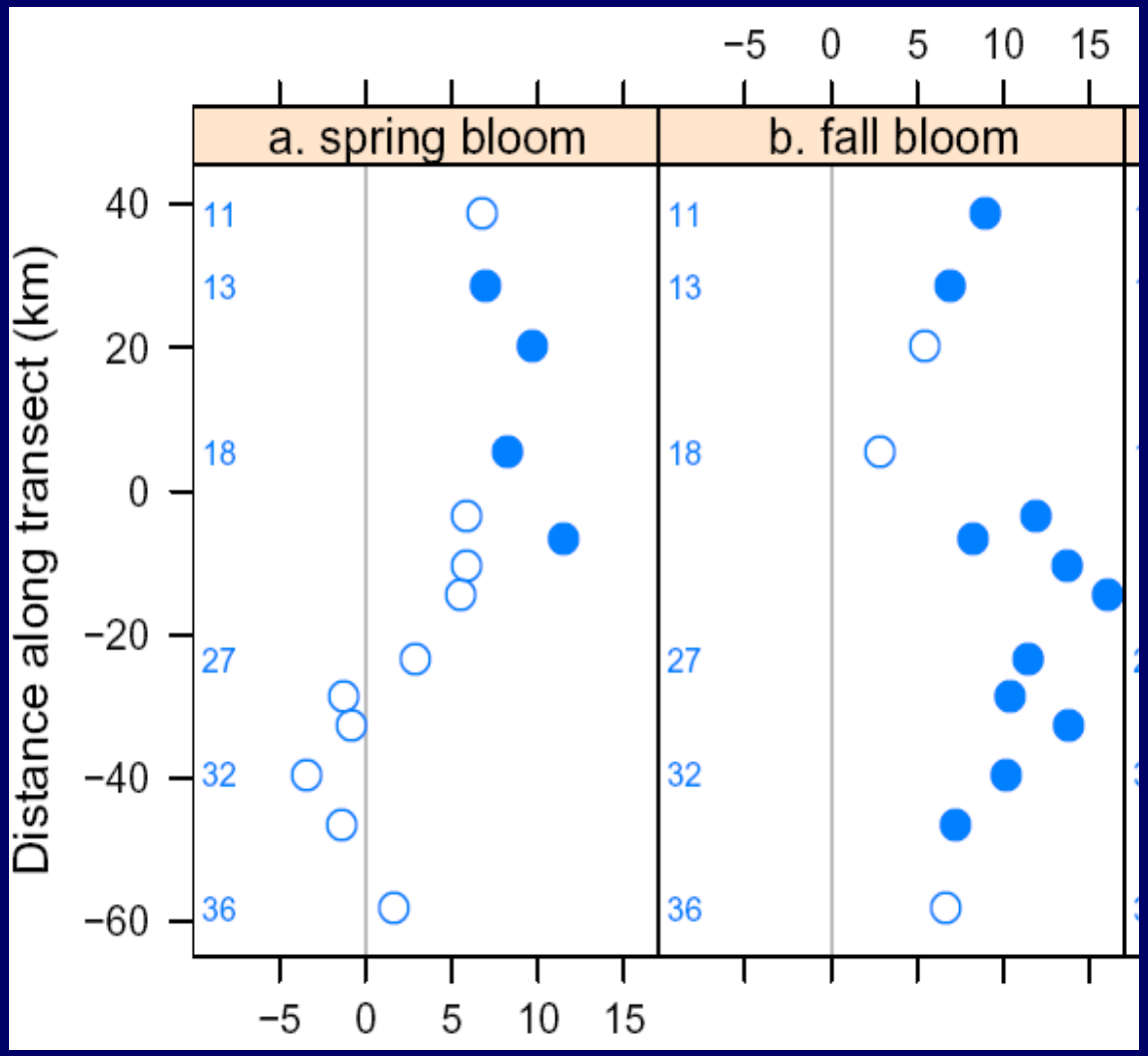


CDFG (data 1986, 1990)

Seasonal Kendall Test for Trends (Helsel & Hirsch 1992)

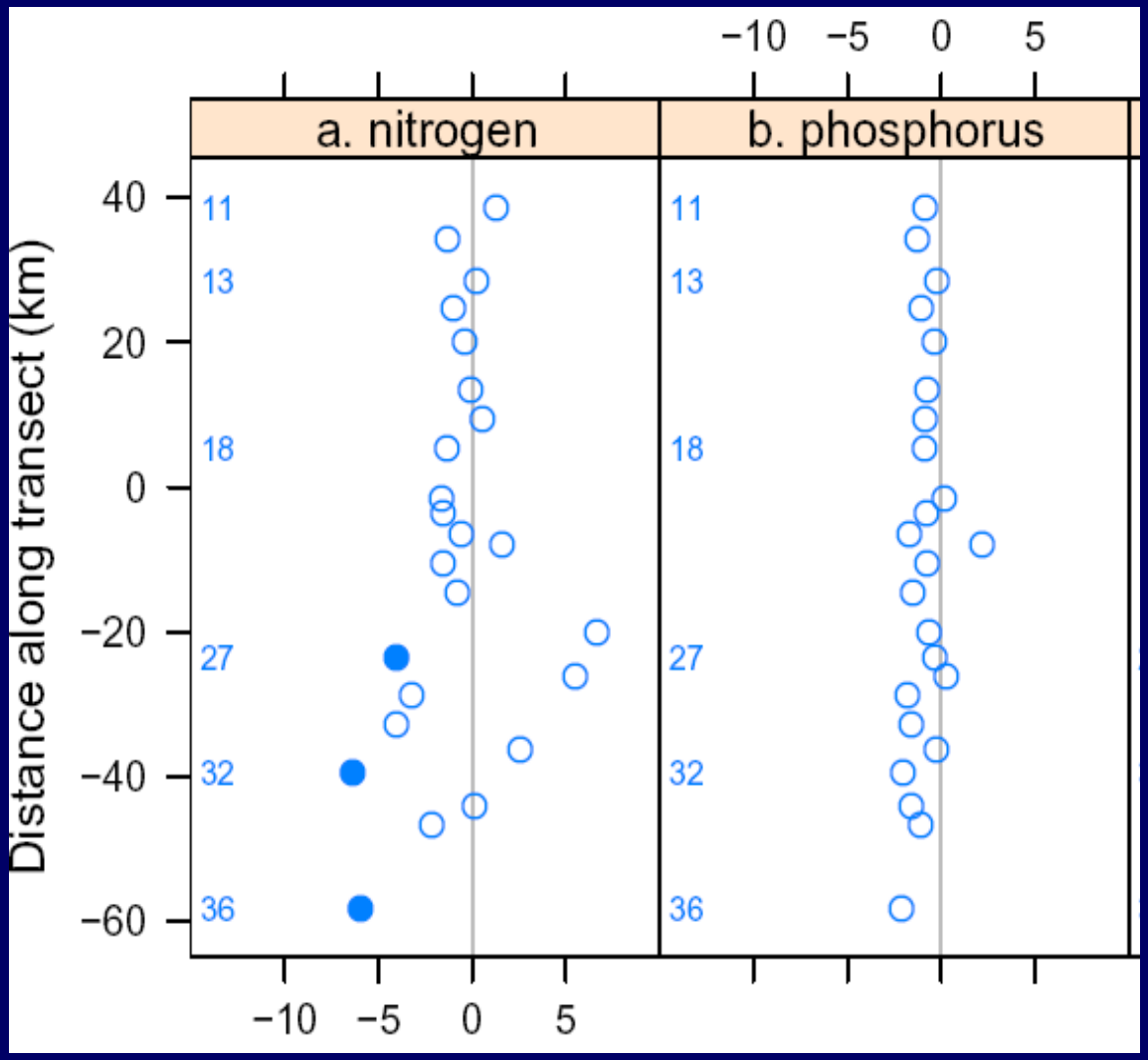


% per year

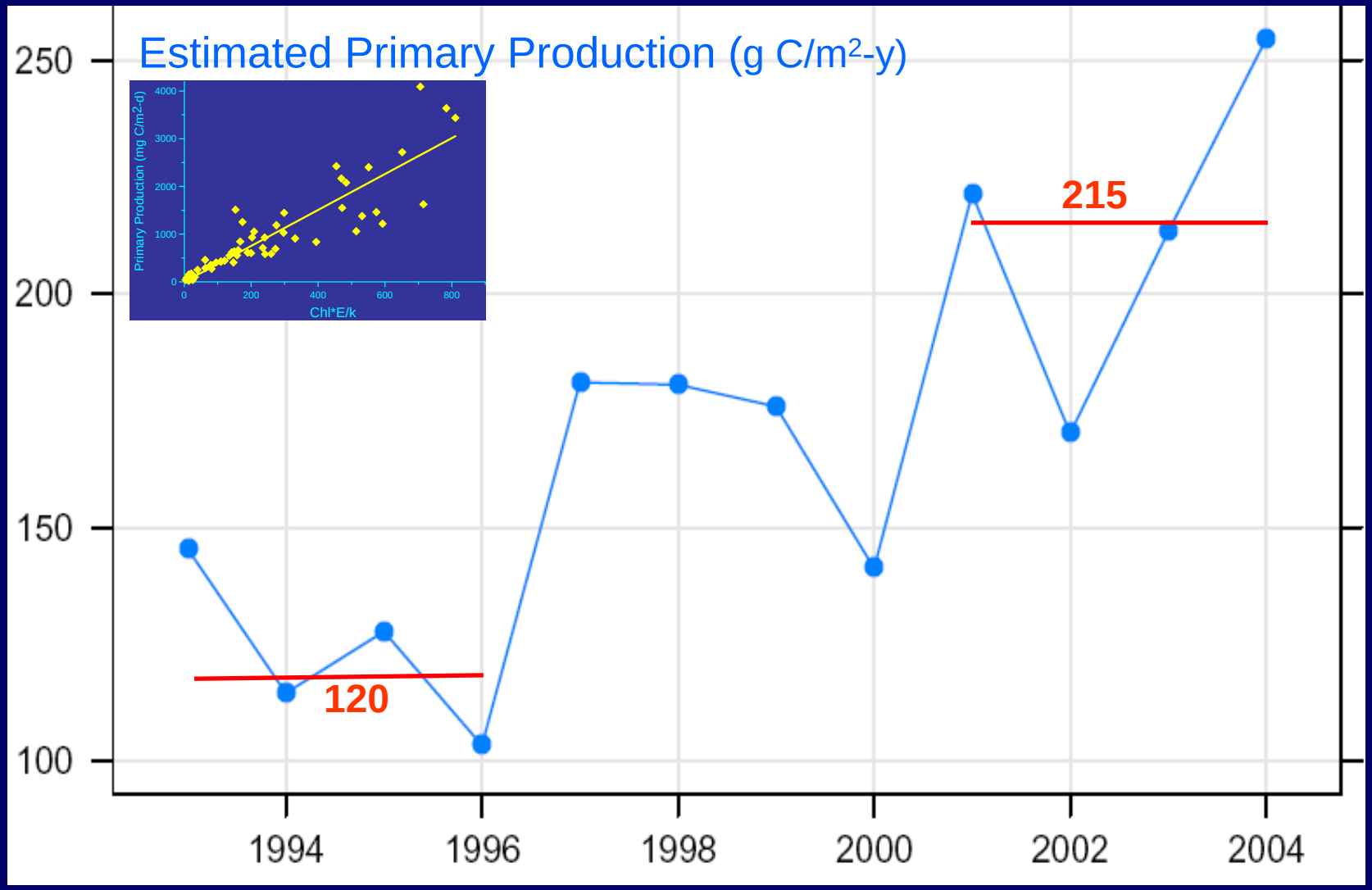

a. spring bloom
b. fall bloom
Distance along transect (km)
40
20
0
−20
−40
−60
11
13
18
27
32
36
−5
0
5
10
15

% per year

Not associated with nutrient increases



% per year


Estimated Primary Production (g C/m2-y)
250
200
150
100
1994
1996
1998
2000
2002
2004
120
215
Primary Production (mg C/m2-d)
4000
3000
2000
1000
0
0
200
400
600
800
Chl*E/k